

Chapter 4

ANALYSIS, METHODS, AND ISSUE IDENTIFICATION

Several methods and sources were used and consulted during the analysis and issue identification phase of the development of this plan including:

- Review of the analysis and issue identification results from the 1994 LWC Water Supply Plan
- Review of consumptive use permitting activities and related data that have occurred since the acceptance of the 1994 LWC Water Supply Plan
- Extensive review and input from the advisory committee
- Data and results from the Caloosahatchee Water Management Plan

The purpose of this chapter is to identify potential water supply related issues (potential problems) that may occur in developing historically used water sources to meet the 2020 projected water demands in the LWC Planning Area. The process and information used for issue identification is described along with the results. The results are summarized in the form of a list of issues that this plan needs to address and resolve. As part of this process, some preliminary water source options to resolve these issues were identified and presented in this chapter.

Potential solutions, or water source options, to resolve these issues are discussed in Chapter 5 (Solution Development). For each water source option, a definition, summary of the committee discussion, estimated costs, quantity of water that could be made available from that option, as well as regional and local recommendations to facilitate development of that option are listed. Chapter 6 (Plan Implementation) breaks the regional recommendations down into tasks and total and annualized cost to implement that recommendation, the entity/agency responsible for implementing the recommendation, and funding sources.

CHAPTER 373 RESOURCE PROTECTION TOOLS AND LEVEL OF CERTAINTY

Before discussing planning area specifics, it is important to understand the relationship between the different levels of harm referred to in statutes and the various programs the District has to protect the resources. The overall purpose of Chapter 373 is to ensure the sustainability of water resources of the state (Section 373.016, F.S.). To carry out this responsibility, Chapter 373 provides the District with several tools, with varying levels of resource protection standards. Protection programs include the District's surface water management and consumptive use permitting regulatory programs, minimum flows and levels (MFLs), and the District's Water Shortage Program.

Determination of the role of each of these and the protection that they offer are discussed below.

Sustainability is the umbrella of water resource protection standards Section 373.016, F.S.). Each water resource protection standard must fit into a statutory niche to achieve this overall goal. Pursuant to Parts II and IV of Chapter 373, surface water management and consumptive use permitting regulatory programs must prevent **harm** to the water resource. Whereas water shortage statutes dictate that permitted water supplies must be restricted from use to prevent **serious harm** to the water resources. Other protection tools include reservation of water for fish and wildlife, or health and safety (Section 373.223(3)), and aquifer zoning to prevent undesirable uses of the ground water (Section 373.036). By contrast, MFLs are set at the point at which **significant harm** to the water resources, or ecology, would occur. The levels of harm cited above, harm, significant harm, and serious harm, are relative resource protection terms, each playing a role in the ultimate goal of achieving a sustainable water resource.

Level of Certainty

Certainty that sufficient water supplies will be available to water users and the environment is provided by varying tools. Level of certainty is the level of assurance provided to consumptive users and the environment that water will be available to meet reasonable demands to specific hydrologic conditions. The level of certainty evaluated in the planning process defines the availability of water to reasonable beneficial uses and the level of protection afforded to the water resources. The following resource protection framework in **Figure 4** is discussed in terms of the level of certainty and the varying tools available under Chapter 373 to protect water resources.

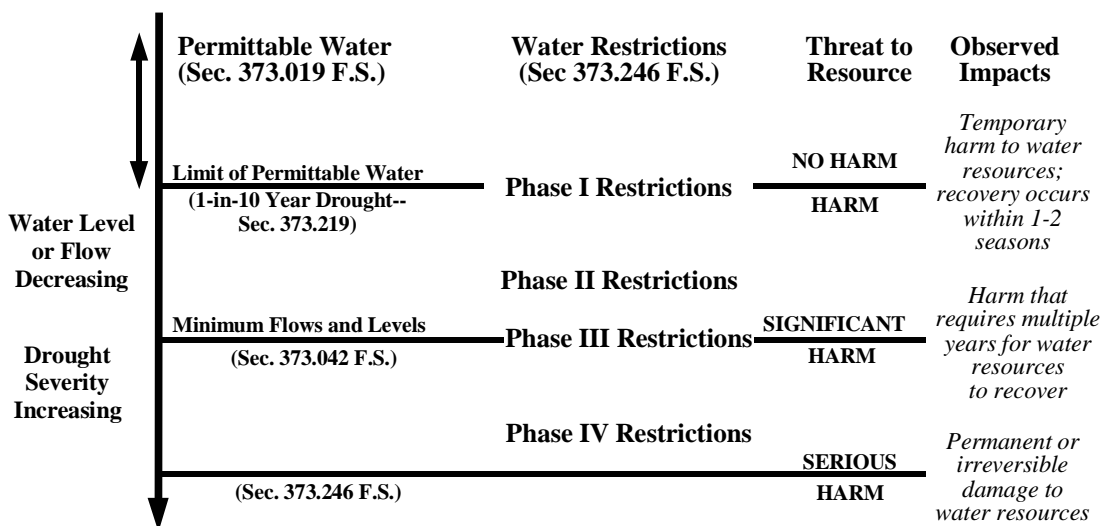


Figure 4. Conceptual Relationship among the Terms Harm, Significant Harm, and Serious Harm.

Water Supply Planning and Level of Certainty

Fundamental to water supply planning is the quantification of existing and projected demands with a level of certainty. The 1997 Water Supply Legislation (CS/HB 715, et al.), requires the water management districts to provide as a part of the regional water supply plan:

[a] quantification of the water supply needs for all existing and reasonably projected future uses within the planning horizon. The level-of-certainty planning goal associated with identifying the water supply needs of existing and future reasonable-beneficial uses shall be based upon meeting those needs for a 1-in-10 year drought event.

These demands are evaluated by water availability assessment tools (ground water/surface water models) to estimate the potential impacts of the associated cumulative use. In this evaluation process, certain assumptions/constraints are defined to protect the water resources from over-development. These constraints identify where in the planning area threats, such as salt water intrusion, wetland stress, pollution, and others, to the water resources could potentially occur.

Another implication of the level of certainty in water supply planning is that it defines where water resource development and water supply development projects need to be implemented to meet the projected demands for the appropriate level of certainty (Section 373.0361, F.S.). Once the water supply plan is completed and the water resource development and water supply development projects are defined, assure all reasonable demands will be met, the regulatory process becomes one of several plan implementation tools. To be consistent with the plan, CUP applications are reviewed using the planning level of certainty and resource protection constraints on a local (project) scale.

Consumptive Use Permitting Link to Level of Certainty

By Section 373.219, F.S., the yield of the source, or amount of water that can be permitted for use, is limited by the resource protection criteria which defines when "harm" will occur to the resource. Resource protection criteria have been adopted by the water management districts using the three-prong test referred to in Section 373.223, F.S., and particularly the reasonable-beneficial use test. These criteria are aimed at preventing saltwater intrusion and upconing, harm to wetlands and other surface waters, aquifer mining, and pollution.

Based on statutory guidance, staff recommends harm be considered as the point at which adverse impacts to water resources occur during drought conditions that are sufficiently severe that they cannot be restored within a period of one to two years of average rainfall conditions. These short-term adverse impacts are addressed in the CUP program, which calculates allocations to meet demands up to the appropriate level of certainty.

Water Shortage Link to Level of Certainty

By basing resource protection criteria on a specific uniform level of certainty, it is possible to predict when water uses may be restricted by water shortage declaration. In a drought more severe than the drought event associated with the level of certainty, consumptive users no longer have the assurances that water will be available for use in their permitted quantities. During these drought conditions, both consumptive users and the water resources will experience a shared adversity.

Pursuant to Section 373.246, F.S., water shortage declarations are designed to prevent serious harm from occurring to water resources. Serious harm, the ultimate harm to the water resources that was contemplated in Chapter 373, F.S., can be interpreted as long-term, irreversible, or permanent impacts. The water shortage trigger levels are tools used to "trigger" imposition of water shortage restrictions based on climatic events, continued decline in water levels and a need to curtail human demand to correspond to decreasing supplies. Each level corresponds to a level of water shortage restriction. These restrictions act to apportion among uses, including the environment, a shared adversity resulting from a drought event. Adoption of the resource protection criteria as water shortage trigger indicators also serves the purpose of notifying users of the risks of water shortage restrictions and potential for loss associated with these restrictions.

Minimum Flow and Level Link to Level of Certainty

Minimum flows and levels are the point at which further withdrawals would cause significant harm to the water resources. Significant harm is recommended to be defined as a loss of specific water resource functions that take multiple years to recover, which result from a change in surface water or ground water hydrology. According to the resource protection framework above, this level of harm requires that consumptive uses be cutback heavily, imposing the potential for economic losses, to prevent significant harm and serious harm. This shared adversity between the environment and water users is implemented through the water shortage program discussed above.

Section 373.0421, F.S. requires that once the MFL technical criteria have been established, the District must develop a recovery and prevention strategy for those water bodies that are expected to exceed the proposed criteria. It is possible that the proposed MFL criteria cannot be achieved immediately because of the lack of adequate regional storage and/or ineffective water distribution infrastructure. These storage and infrastructure shortfalls will be resolved through water resource development and water supply development projects, construction of facilities and improved operational strategies that will increase the region's storage capacity and improve the existing delivery system. Planning and regulatory efforts will, therefore, include a programmed recovery process that will be implemented with time to improve water supply and distribution to protect water resources and functions. The process for establishing MFLs can be summarized as follows:

1. Identify water resource functions of water body.
2. Identify considerations/exclusions.

3. Identify narrative definition of significant harm.
4. Identify numeric criteria to reflect significant harm.
5. Conduct independent scientific peer review of the MFL Technical Criteria and incorporate the revisions suggested by the panel and deemed appropriate.
6. Develop MFL Recovery and Prevention Strategy.
7. As part of the development of the recovery strategy, conduct appropriate technical analyses to determine the water supply implications of the proposed MFL criteria on existing legal uses. These results will be integrated into the Regional Water Supply Plan analysis with appropriate implementation measures developed consistent with Section 373.0421, F.S.
8. Following completion of the scientific peer review process, initiate Rule Development after Governing Board consideration of the peer review results and appropriate revisions.

Minimum Flows and Levels Recovery and Prevention Strategy

Section 373.0421, F.S. requires that once the MFL technical criteria have been established, the District must develop a recovery and prevention strategy for those water bodies that are expected to fall below the proposed criteria. It is possible that the proposed MFL criteria cannot be achieved immediately because of the lack of adequate regional storage and/or ineffective water distribution infrastructure. These storage and infrastructure shortfalls will be resolved through water resource development and water supply development projects, construction of facilities and improved operational strategies that will increase the region's storage capacity and improve the existing delivery system. Planning and regulatory efforts will, therefore, include a programmed recovery process that will be implemented over time to improve water supply and distribution to protect water resources and functions. Development of a MFL recovery and prevention plan for the water resource will be incorporated into the regional water supply planning process to ensure consistency.

1994 LWC WATER SUPPLY PLAN

The District's Governing Board approved the first LWC Water Supply Plan in February 1994 (1994 LWC Water Supply Plan). The 1994 LWC Water Supply Plan had a 2010 planning horizon and an advisory committee was established to provide public input throughout development of the 1994 LWC Water Supply Plan. The 1994 LWC Water Supply Plan incorporated regional ground water modeling as part of the analysis. The demand projections, assumptions, and resource protection criteria used in that analysis were reviewed and compared to current information and it was determined that many of the conclusions of the 1994 LWC Water Supply Plan are applicable today with the current planning horizon of 2020.

Staff and the committee recognized the findings and conclusions of the 1994 LWC Water Supply Plan as still representative of the issues in meeting the LWC Planning Area

projected water demands; and, they should be considered in the development of the 2000 LWC Water Supply Plan, in combination with other methods described below. It was concluded that the modeling associated with 1994 LWC Water Supply Plan is indicative of the 2020 scenario. Even though the 1994 LWC Water Supply Plan preceded the water supply planning requirements in Chapter 373, F.S., review of the 1994 LWC Water Supply Plan indicates many of the elements were addressed.

1994 LWC Water Supply Plan Level of Certainty

The 1994 LWC Water Supply Plan incorporated a 1-in-10 level of certainty for all users, including natural systems. The 1-in-10 level of certainty was based on a twelve month cumulative drought rainfall event, that statistically occurs once every ten years. This certainty level was simulated in each county model and is consistent with the level of certainty goal contained in the statutory requirements. The methodology used in determining the 1-in-10 drought event in the 1994 LWC Water Supply Plan is described in that Plan's Appendix C, and a similar discussion of methodology is provided in Appendix B of the 2000 LWC Water Supply Plan. The demand projections and resource protection criteria incorporated the 1-in-10 level of certainty.

1994 LWC Water Supply Plan Demands

The water demand projections in the 1994 LWC Water Supply Plan were compared with projections developed for the 2020 planning horizon in the 2000 LWC Water Supply Plan. The 1994 LWC Water Supply Plan incorporated a planning horizon of 2010. Population projections in the 1994 LWC Water Supply Plan were based on 2010 population projections contained in local government comprehensive plans. The 2000 LWC Water Supply Plan uses the 2020 medium range population projections, as published by the Bureau of Economic and Business Research (BEBR, 1998). The 2020 projections have been compared to recent updates of local government comprehensive plans, where available, and have been found to be similar. In both plans, irrigated acreage was based on historical growth patterns and irrigation demands were determined using the modified Blaney-Criddle method as described in the Basis of Review (BOR) for Consumptive Use Permitting (SFWMD, 1997) using a 1-in-10 drought event. See Appendix G of the 1994 LWC Water Supply Plan and Appendix F of the 2000 LWC Water Supply Plan for additional information regarding the projection and demand methodologies used in each plan.

The results of this comparison concluded that the total average water demand projections in the 1994 LWC Water Supply Plan for 2010 are approximately 15 percent higher than those projected for 2020 in the 2000 LWC Water Supply Plan. The total average water demands projected for 2010 in the 1994 LWC Water Supply Plan were 471,507 MGY; whereas, the total average water demands projected for 2020 in the 2000 LWC Water Supply Plan are 401,548 MGY. This reduction in total demands is attributed primarily to the decrease in the rate of population and agricultural growth in the LWC Planning Area from the late 80s to the 90s.

1994 LWC Water Supply Plan Resource Protection Criteria

Resource protection criteria in the 1994 LWC Water Supply Plan were designed to prevent harm to the resources up to a 1-in-10 drought event. These criteria are not intended to be a minimum flow and level. For drought conditions greater than a 1-in-10 event, it may be necessary to decrease water withdrawals to avoid causing significant and serious harm to the resource. Water shortage triggers, or water levels at which phased restrictions will be declared using the District's water shortage program, can be used to curtail withdrawals by water use types to avoid water levels declining to and below a level where serious harm to the resource could potentially occur.

Three resource protection criteria were used in the 1994 LWC Water Supply Plan: wetland protection criterion, seawater intrusion criterion, and general aquifer protection criteria. These criteria were intended to be equivalent to the existing CUP guidelines at that time, but for planning purposes. To be used in the planning analysis, the criteria had to be defined in terms of water levels, duration, and frequency of drawdowns, to assess the potential impacts (harm) of cumulative water use on the environment and ground water resources using the ground water modeling tools. The CUP guidelines were not expressed in this format, such that the CUP criterion had to be converted to an equivalent criterion, expressed in the format stated above, for planning purposes.

The resource protection criteria are guidelines to identify areas where there is potential for cumulative water use withdrawals to cause harm to wetlands and ground water resources. Areas where simulations indicate the resource protection criteria were exceeded during the selected level of certainty are areas where the water resource may not be sufficient to support the projected demand under the given constraints.

Wetland Protection Criterion

The wetland protection criterion was defined as follows: *Ground water level drawdowns induced by pumping withdrawals should not exceed 1 foot for more than 1 month during any drought event that occurs as frequently as once every 10 years in areas that are classified as a wetland.* This criterion was intended to be equivalent with the CUP guidelines, but for planning purposes. The wetland coverage used in the 1994 LWC Water Supply Plan was developed using information from the 1984 National Wetlands Inventory (NWI). The NWI data was updated by the District using 1990 and 1991 satellite images and aerial photographs.

The CUP criteria contained in Section 3.3, Environmental Impacts, of the District's Basis of Review for Water Use Permit Applications (SFWMD, 1997) requires that withdrawals of water must not cause adverse impacts to environmental features sensitive to magnitude, seasonal timing and duration of inundation. Maintaining appropriate wetland hydrology (water levels and hydroperiod) is scientifically accepted as the single most critical factor in maintaining a viable wetland ecosystem (Duever, 1988; Mitsch and Gosselink, 1986; Erwin, 1991). Water use induced drawdowns under wetlands potentially affect water levels, hydroperiod, and the areal extent of the wetland. A guideline of no greater than one foot of drawdown at the edge of a wetland after 90 days of no recharge

and maximum day withdrawals is used currently for consumptive use permitting (CUP) purposes to indicate no adverse impacts. Wetlands for CUP purposes are delineated using the statewide methodology as described in Chapter 62-340, F.A.C.

The District began a research project in 1995 referred to as the Wetland Drawdown Study to support refinement of the wetland drawdown criterion. This project involves long-term monitoring of wellfields and wetland systems at 20 sites throughout the District, including wetlands in the Flint Pen Strand adjacent to the Corkscrew wellfield in the LWC Planning Area. Three years of data collection and analysis has been conducted to determine the relationship between variations in hydrology and wetland functions. In May 1998, seventeen additional sites were established in the LWC Planning Area to monitor the effects of agricultural pumpage. The information gathered to date is being used to support incorporation of wetland protection criteria in the CUP program. These proposed criteria might differ in some cases from that used in the 1994 LWC Water Supply Plan. Three wetland system types with differing levels of protection are proposed. However, the criterion used in the 1994 LWC Water Supply Plan is sufficient for planning purposes in that a majority of the wetland systems in the LWC Planning Area would have a protection criterion similar to the criterion used in the Plan. The District has initiated a rulemaking effort this year to adopt rules districtwide to incorporate these concepts in the CUP process.

Seawater Intrusion Criterion

Generally, this criterion provided for a positive freshwater head to impede the movement of saline water inland up to and including a 1-in-10 year drought event. This criterion was applied to the Surficial Aquifer System (SAS) and Intermediate Aquifer System (IAS) in selected coastal locations in Lee and Collier counties and was intended to mimic the existing criterion used in the CUP program. The purpose of this criterion was to identify areas where water withdrawals would reduce the fresh water head along the coast below one foot, and increase the potential for seawater intrusion.

Current CUP criteria requires site-specific analysis and maintenance of a one foot freshwater head. In addition to using this CUP program criterion to minimize potential changes in salinity of these freshwater resources, the District also has an extensive complementary ground water monitoring network to monitor water quality for changes, including salinity, to maintain the sustainability of these resources. The District has initiated a rulemaking effort this year to adopt rules districtwide to incorporate these concepts in the CUP process. Current proposed criterion incorporated in information to support the current rulemaking uses net inward flow across the saltwater interface as criterion to determine the potential for seawater intrusion. This criterion is consistent with the 1994 LWC Water Supply Plan criterion.

General Aquifer Protection Criteria

The general aquifer protection criterion was defined as follows: *Ground water levels should not decline below the top of the aquifer for any period of time during any drought event that occurs as frequently as once every ten years.* This definition was

applied to all confined aquifer systems in the LWC Planning Area to identify areas where potential ground water level declines due to water use may cause aquifer compaction and dewatering, reduced well yields, land subsidence, and upconing of saline water. This concept will be developed to form the basis for defining significant harm to the aquifer and will be used for establishing minimum flows and levels for aquifer protection. The District has initiated a rulemaking effort this year to adopt rules districtwide to incorporate these concepts in the CUP process.

1994 LWC Water Supply Plan Results

The results of the 1994 LWC Water Supply Plan analysis indicated that if existing sources of water (base case) are used to meet the projected demands, this use has the potential to cause exceedances of the resource protection criteria. The areas where exceedances of the resource protection criteria were projected if historically used sources of water are used to meet the projected 2010 demands are generalized in **Figure 5**.

Taking into consideration the information and knowledge gained since the approval of the 1994 LWC Water Supply Plan, it was concluded that the 1994 LWC Water Supply Plan analysis represents a worst case scenario. This conclusion is based on several considerations, some of which are summarized next. The projected water demands in the 2000 LWC Water Supply Plan are less than those projected in the 1994 LWC Water Supply Plan, and the wetland coverage used in the 1994 LWC Water Supply Plan was developed in 1984, and was updated by the District using 1990 and 1991 satellite images and aerial photographs. More recent assessments of some of the wetlands have indicated that they have been affected by development, and in some cases, are nonexistent. Also, some of the potential problems that were identified on a regional scale in the 1994 LWC Water Supply Plan associated with 1990 withdrawals, were not identified as issues or have been resolved on a local scale through the District's CUP process. In addition, many PWS users have diversified supply sources with use of the FAS and enhancing freshwater water availability through ASR; reclaimed water use in the area has increased; several surface water management modifications to increase regional retention have been completed; and conversion of flood irrigation to micro irrigation has continued. Most of the recommendations in the 1994 LWC Water Supply Plan have been implemented, as summarized later in this chapter.

Several water resource options, and combinations of options, were evaluated to determine their potential effectiveness in meeting a portion of the projected demands and reducing potential exceedances. These source options included use of the FAS to meet PWS demands, increased use of reclaimed water, modifying surface water management in the Big Cypress Basin, and increasing agricultural efficiency. No analysis of the Floridan aquifer was conducted in the 1994 LWC Water Supply Plan. The analysis found reducing demands on the SAS and IAS, through the use of the FAS and reclaimed water in the coastal portions of the LWC Planning Area, was very effective at reducing potential exceedances of the wetland protection and seawater intrusion criteria. Increasing agricultural efficiency and improving surface water management in the Big Cypress Basin also had some effect on reducing potential exceedances. The analysis indicated minimal

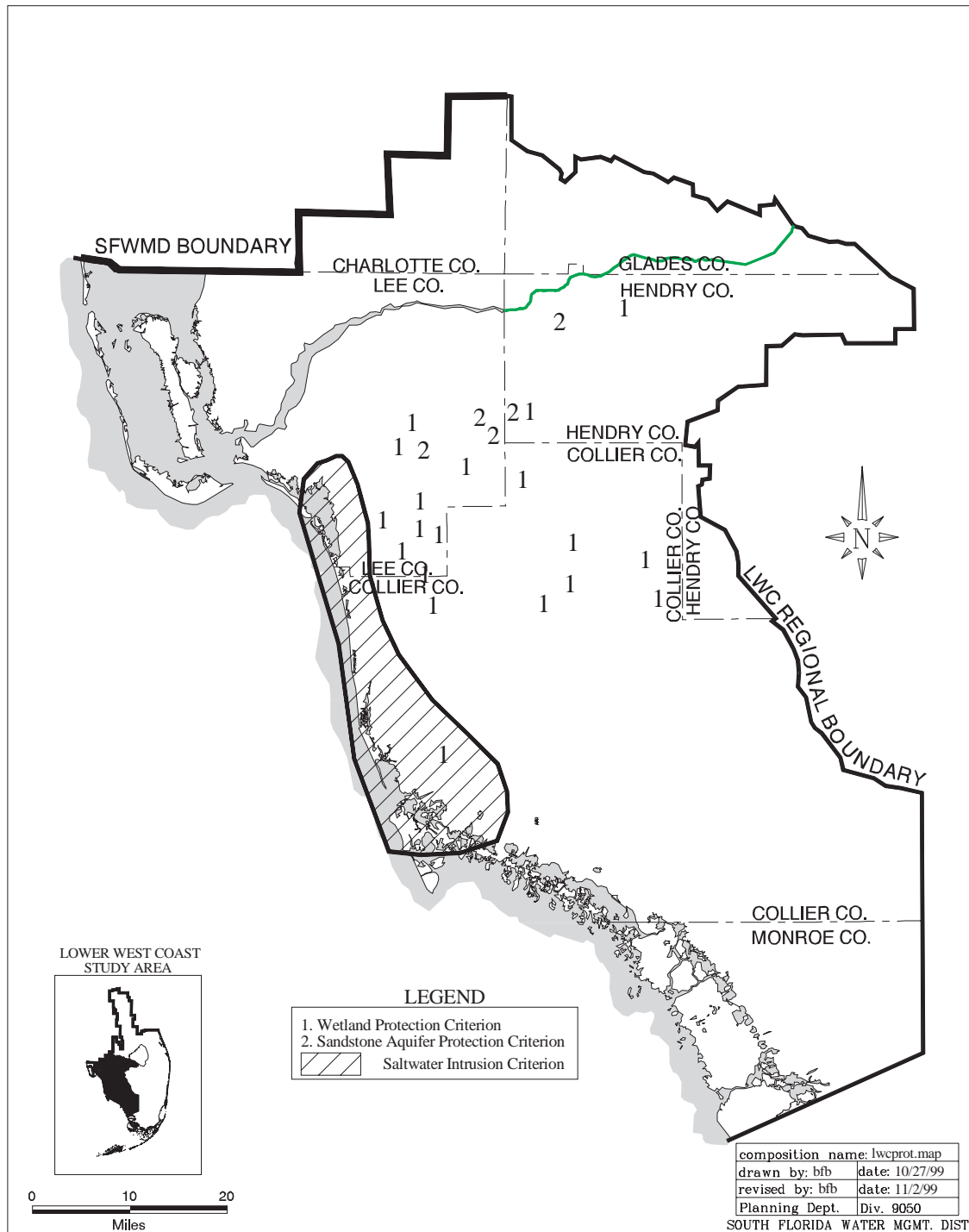


Figure 5. 1994 Lower West Coast Water Supply Plan 2010 Generalized Base Case Potential Resource Protection Criteria Exceedances.

exceedances of the general aquifer protection criterion for the Sandstone aquifer. It was concluded that these were attributed to local uses and could be managed through water supply development projects, as well as the CUP program.

The analysis indicated that with diversification of supply sources, through development and expansion of alternative sources, the number of exceedances were significantly reduced. However, the 1994 LWC Water Supply Plan identified areas where potential problems were not completely resolved. A majority of these were located in agricultural areas. Since the 1994 modeling and identification of these potential problem areas, additional work has been conducted related to these areas. Some of the factors that were examined included projected demands, current land use, CUP experience, field inspection, and the District's wetland drawdown study.

These additional efforts found projected 2020 agricultural acreage and demands are approximately 25 percent less than those projected and simulated in the 1994 LWC Water Supply Plan. The 2020 projections are approximate to those acreages that have been permitted to date by the District. Generally, actual crop acreages are less than permitted acreage due to lags between permitting and planting. The 2020 projected acreage represents anticipated actual land use rather than forecast permitted land use. As a result, most of the additional agricultural expansion in the LWC Planning Area will occur within existing permitted, and planted, areas.

Other factors included some of the agricultural land use associated with the potential problem areas in the 1994 LWC Water Supply Plan has been converted to urban land use with significantly less water demands than assumed in the 1994 LWC Water Supply Plan. Also, several applications for consumptive use permits in these areas have been approved since the 1994 LWC Water Supply Plan. Several of these projects required modification to wellfield locations and pumping regimes with respect to wetlands prior to approval. In other areas, aerial photography was reviewed over several decades and did not indicate changes in the size or vegetation of these systems. In addition, information collected as part of the District's wetland drawdown study suggests that seasonally inundated wetlands (a majority of the wetlands in the LWC Planning Area) are more sensitive to drawdowns during the wet season, rather than the dry season. Whereas, the 1994 LWC Water Supply Plan analysis evaluated drawdowns based on a 12-month 1-in-10 drought condition, and many potential problems were triggered on drawdowns that occurred during the dry season. Current wetland protection guidelines/criteria are being revised to address these findings.

The 1994 LWC Water Supply Plan analysis used the best available information at that time. Based on the knowledge that has been gained since the 1994 LWC Water Supply Plan was approved, the results may be considered conservative, but still provide value. Within these areas, water users and the District should carefully evaluate proposed withdrawals with respect to wetlands, during the CUP process. Based on the above, and that additional agricultural development will be distributed throughout the eastern portions of the LWC Planning Area and occur within existing permitted and planted areas, it was concluded the projected agricultural demands in these areas can be met through historically used ground water sources. In the future, refined regional ground water

models that are under development for renewal of CUPs, will be used to validate this conclusion, and will be available for future updates of this plan.

1994 LWC Water Supply Plan Conclusions and Recommendations

The 1994 LWC Water Supply Plan concluded that historically used sources of water, primarily fresh ground water sources, are not sufficient to meet the projected demands through the planning horizon. The 1994 LWC Water Supply Plan recommended new sources of water be explored and used, including the Floridan Aquifer System (FAS) and increased use of reclaimed water, increased water conservation, and research to meet the projected demands, to reduce the potential for harm to wetlands and the water resources. The 1994 LWC Water Supply Plan also recommended more efficient use of water by increasing urban and agricultural water conservation, revising drainage management practices, and developing cost-sharing partnerships. The 1994 LWC Water Supply Plan analysis concluded that implementation of the above significantly reduce the number of potential problems.

For consistency between the 1994 LWC Water Supply Plan and the CUP Program, it was recommended that the resource protection criteria used in the Plan be incorporated into the District's BOR for CUP. Additional research was also recommended to better understand the potential impacts to natural systems and to develop water shortage management strategies tied to the CUP process.

1994 LWC Water Supply Plan Implementation

Many of the recommendations in the 1994 LWC Water Supply Plan are being realized, including increased utilization of the FAS, aquifer storage and recovery, and reclaimed water usage. The District has provided funding through the Alternative Water Supply Grant Program for 27 alternative water supply projects in the LWC Planning Area totaling \$6.3 million (District contribution) between 1996 and 2000. The projects included 10 reclaimed water/reuse projects (\$1 million), 10 ASR projects (\$2.5 million), 3 projects improving surface water management to retain more water in the system and recharge aquifers (\$0.5 million), and one Floridan aquifer project (\$0.2 million). In addition, the Big Cypress Basin has expended several million dollars in modifying their drainage system to retain more water within their system.

Research on the FAS was conducted as a result of the 1994 LWC Water Supply Plan. Based on the recommendations of the 1994 LWC Water Supply Plan, the District initiated a program of well construction, aquifer testing, and long-term monitoring to provide data needed to assess the FAS underlying the LWC Planning Area. The District drilled five test wells and five associated monitoring wells between 1994 and 1999. Aquifer performance tests were performed on these wells to define the hydraulic characteristics of various sections of the FAS. This testing provided information to characterize the water supply potential of the FAS and to support future development of a FAS ground water model. The total cost of this study was \$3.1 million.

In addition, the recommendations in the 1994 LWC Water Supply Plan were used to initiate the District's wetland drawdown study. The District began formulating a research plan to support development of wetland drawdown criteria in 1995. The purpose of this study is to implement hydrobiological monitoring at various wetland sites throughout the District to determine the effects of ground water drawdowns on these systems. Twenty sites in four study areas were established and instrumented in 1997. Isolated wetlands in the Flint Pen Strand adjacent to the Corkscrew wellfield in the LWC Planning Area were included in the study. Three years of data collection and analysis has been conducted to determine the relationship between variations in hydrology and wetland functions. This information has been incorporated into a draft publication that will be used to support the District's 2000 CUP wetland rulemaking activity. In May 1998, seventeen additional sites were established in the LWC Planning Area to monitor the effects of agricultural pumpage. The District has invested \$1.8 million into this study to date.

The 1994 LWC Water Supply Plan contained recommendations to incorporate certain aspects of that plan, such as the resource protection criteria and level of certainty, into the CUP Basis of Review. These recommended changes are still outstanding due to statutory changes and public concern regarding consistency with the other planning areas in the District (1994 LWC Water Supply Plan was completed before other regions). The District has initiated a rulemaking effort this year to adopt rules districtwide to incorporate the 1-in-10 level of certainty and other concepts in the CUP process.

2000 LWC WATER SUPPLY PLAN

Issue Identification

Implementation of the 1994 LWC Water Supply Plan recommendations is addressing most of the potential exceedances identified in that plan if historically used sources were utilized to meet projected 2010 demands. It is important to note that based on the demands that are projected for 2020 and other information referred to early in this chapter, it appears the 1994 LWC Water Supply Plan 2010 simulation overstates demand and potential exceedances that would be expected in 2020. To resolve the remaining issues/exceedances identified in the 1994 LWC Water Supply Plan, as well as those identified by the advisory committee and staff as part of this plan, a process was developed to address these issues in accordance with the water supply planning requirements in Chapter 373, F.S. This process utilized the knowledge and experience of the advisory committee, public, and staff; information from the analysis associated with the CWMP; information from the analysis associated with the 1994 LWC Water Supply Plan; and experience from consumptive use permitting activities and related data that have occurred since the acceptance of the 1994 LWC Water Supply Plan.

For the purposes of this approach, the LWC Planning Area was divided into eight "issue areas" (**Figure 6**) to facilitate discussion and identification of potential issues and options to resolve them. Several considerations were used to delineate these areas including land use, existing and projected water demands, drainage features, surface water

bodies, and historically used sources of water. These eight areas and general characteristics are summarized below (no implied priority).

Because most of the information regarding population, agricultural acreage, and their associated demands was available in formats not identical to the "issue areas" boundaries; population, agricultural acreage and their associated demands were qualitatively described versus using specific numbers in the "issue areas". For example, the service areas of water and wastewater utilities are not mutually exclusive, such that increases in public water supply (PWS) demand are not proportionate to increases in wastewater flows in some areas. Also, most of the PWS demand located in the coastal areas is supplied with water from inland wellfields, sometimes located in other issue areas. In addition, the interconnection of utility systems, such as in Lee County, allows water to be moved from one area to another.

For each of the issue areas, emphasis was placed on water conservation for both potable demands and irrigation demands. It is recommended advances in water conservation beyond those currently required be encouraged, and conservation be considered as a source option in meeting the 2020 demands.

Following the list of characteristics is a summary of the ensuing discussion of issues and potential solutions. It is important to recognize that the purpose of the area designation is viewed as only a means to organize the discussion and are presented here only to document the methodology followed in the public process.

Issue Area 1

Issue Area 1 includes the barrier islands and coastal communities in Northwest Lee County including Sanibel, Pine Island, Cape Coral, and Fort Myers. Natural features include the Ding Darling National Wildlife Refuge, the lower reaches of Gator Slough and many tidally influenced creeks that drain into the Caloosahatchee River. The area consists primarily of urban land use with minimal agricultural areas. The following generalized characteristics and issues were identified for Area 1:

Demand Characteristics

- Utilities: Island Water Association, Greater Pine Island, Cape Coral, Lee County Waterway Estates, Fort Myers
- Significant increases in population and PWS demands projected
- Large urban irrigation demands projected

Resource Availability

- Surface water from the Caloosahatchee River
- Limited freshwater sources available
- Most utilities utilizing (or proposing to utilize) FAS to meet existing and future PWS demands

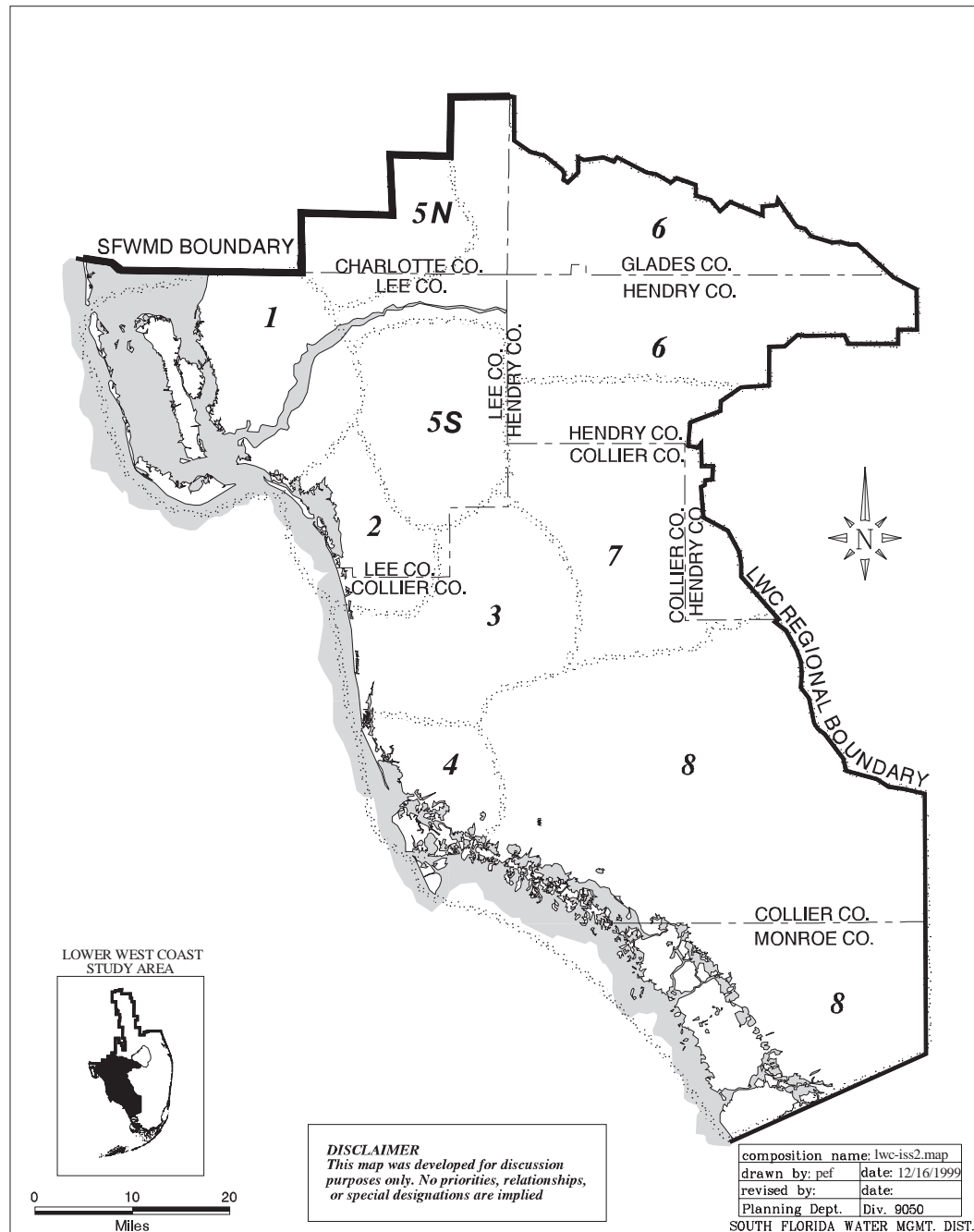


Figure 6. Lower West Coast Issue Areas.

- Fort Myers is developing a FAS wellfield and reverse osmosis for PWS and plan to abandon surface water for PWS

Reclaimed Water Availability

- 1997 wastewater treated - 27 MGD; 12 MGD reused
- 2020 projected wastewater flows - 45 MGD
- Cape Coral Utilities uses reclaimed water and water from canals for irrigation of residential lots (WICC)
- Future increases in reclaimed water supply will lag behind demands

Water Storage Ability

- Cape Coral canal system
- Surface water ASR
- Gator Slough Project
- Reservoirs

Based on the above, two major water supply related issues were identified in Area 1 in meeting the water needs of a growing population: potable water demands and nonpotable water demands for irrigation. There was support for current utility plans to continue using the FAS as a source for potable water with desalination treatment. However, because of the limited fresh ground water (due to wetland protection and saltwater intrusion) and surface water resources in this area, it was concluded additional water source options should be explored and developed to meet the future irrigation water needs of this area.

To address future demands for irrigation water, the concept of construction and operation of expanded reclaimed water systems to provide a series of regional or subregional irrigation distribution systems was discussed and supported. Potential sources of water to support the irrigation water distribution system include reclaimed water, ground water, and surface water, with ASR and reservoir storage options.

Issue Area 2

Issue Area 2 includes the coastal communities in Southwest Lee County and extreme Northwest Collier County and includes Bonita Springs City. Natural features include portions of the Corkscrew Regional Ecosystem Watershed lands and many tidally influenced tributaries that drain into the Estero Bay Aquatic Preserve including the Estero River, Imperial River, and Hendry, Mullock and Spring creeks. The area consists primarily of urban land use with minimal agricultural areas. The following generalized characteristics and issues were identified for Area 2:

Demand Characteristics

- Utilities: Bonita Springs, Gulf San Carlos & Corkscrew, Lee County Cypress Lakes/Green Meadows and Corkscrew, Orangetree

- Significant increases in population and PWS demands projected
- Large growth anticipated consisting of high density golf course developments
 - increase in PWS demands
 - increase in demands for irrigation water
- Transition in land use from agriculture to urban

Resource Availability

- Surface water from the Caloosahatchee River through interconnected PWS systems
- Limited expansion of historically used sources due to:
 - saltwater intrusion
 - wetland protection
- Chronic water shortage area
- Saline IAS and FAS
- mid-Hawthorn drawdown concerns
- Several PWS systems use ground water sources from Area 5

Reclaimed Water Availability

- 1997 wastewater treated - 11 MGD; 9 MGD reused
- 2020 projected wastewater flows - 19 MGD
- Available quantity significantly below demands
- Future increases in reclaimed water supply will lag behind demands

Water Storage Ability

- ASR source issues
- Limited surface water sources

Similar to Issue Area 1, two major water supply related issues were identified in Area 2 in meeting the water needs of a growing population: potable water demands and nonpotable water demands for irrigation. With the interconnection of utilities in Lee County and the ability to diversify supply sources such as surface water, along with utilization of the FAS in Collier County, it was concluded that PWS demands could be met. However, it was also concluded that the lower Tamiami aquifer may be insufficient to meet the 2020 projected demands in Bonita Springs primarily because of saltwater intrusion and excessive drawdowns in the aquifer, and that developing other source options would be necessary. Water source options, either on a local or regional scale, should be investigated.

In addition, because of the limited fresh ground water (due to wetland protection and saltwater intrusion) and surface water resources in this area, it was concluded additional water source options should be explored and developed to meet the 2020 projected cumulative irrigation water needs of this area. Similar to Issue Area 1, the

concept of construction and operation of expanded reclaimed water systems to provide a series of regional or subregional irrigation distribution system was discussed and supported. Besides reclaimed water, consideration should be given to potential surface water sources such as the Imperial River, Ten Mile Canal, Kehl Canal, and Six Mile Cypress Slough surface water resources.

Issue Area 3

Issue Area 3 encompasses Central Collier County including Naples and Golden Gate. Natural features include Lake Trafford and portions of Corkscrew Swamp and Picayune Strand State Forest. The area consists of urban and agricultural areas with some of the agriculture transitioning into urban land uses. The following generalized characteristics and issues were identified for Area 3:

Demand Characteristics

- Utilities: Naples, Collier County, Golden Gate
- Urban development to west; agriculture to east; some transition of land use anticipated in east
- Significant increases in population and PWS demands projected
- Low to moderate increase in Naples demands
- Low density in Golden Gate Estates/higher densities in golf course communities
- Moderate to high increase in demands in unincorporated Collier County
- 50,000+ acres of agriculture (citrus & vegetables) with moderate growth projected

Resource Availability

- Limited to moderate expansion of historically used sources due to:
 - saltwater intrusion in coastal areas
 - wetland protection with the SAS
- Collier County PWS diversified sources: FAS, ASR, reclaimed water
- Lower Tamiami aquifer available for increased domestic irrigation supply
- East Golden Gate Wellfield configuration currently considered maximized

Reclaimed Water Availability

- 1997 wastewater treated - 14 MGD; 9 MGD reused
- 2020 projected wastewater flows - 33 MGD
- Limited availability during peak demand
- Future increases in reclaimed water will lag behind demands

Water Storage Ability

- BCB canal optimization
- Collier County ASR

Three water supply related issues were identified in Area 3 in meeting the water needs of a growing population: potable water demands, urban irrigation water demands, and agricultural irrigation demands. There was support for Collier County's continued use of the FAS to meet future PWS demands. Other utility plans for continued use of the lower Tamiami Aquifer are marginal, but appear to be satisfactory. Collier County has developed an extensive reclaimed water distribution system. However, because of the limited fresh ground water (due to wetland protection and saltwater intrusion) and surface water resources in this area, it was concluded additional water source options should be explored and developed to meet the future urban irrigation water needs of this area.

It was concluded projected agricultural water demands could be met from existing sources through modifications to wellfield configurations and pumping regimes with respect to locations of wetlands.

Issue Area 4

Issue Area 4 generally consists of Southwest Collier County including Marco Island. Natural features include major portions of the Picayune Strand State Forest, Cape Romano Ten Thousand Islands National Wildlife Refuge, Rookery Bay Aquatic Preserve and Collier-Seminole State Park. The area is primarily urban land use and natural areas. The following generalized characteristics and issues were developed for Area 4:

Demand Characteristics

- Utilities: Marco Island, Collier County
- Minor increases in population and PWS demands projected on a regional basis
- Growth anticipated in golf course developments
 - some increase in PWS demands
 - increased demands for irrigation water
- Agriculture - small vegetables
- Transition in land use from agriculture to urban

Resource Availability

- Limited freshwater available due to saltwater intrusion
- Utility diversified sources: surface water, ASR, FAS

Reclaimed Water Availability

- 1997 wastewater treated - 1.4 MGD; 0.5 MGD reused
- 2020 projected wastewater flows - 3 MGD
- Limited availability during peak demand

Water Storage Ability

- ASR source issues

Marco Island is the only utility with withdrawal facilities in Issue Area 4. The utility is utilizing surface water, the FAS, ASR for storage, and has an expanding reclaimed water program. As a result, it was concluded projected potable water demands and irrigation demands on the island could be addressed at the local level.

However, because of the limited fresh ground water and surface water resources on the mainland within this issue area, it was concluded additional water source options should be explored and developed to meet the future irrigation water needs on the mainland. One source option that was suggested was a regional irrigation distribution system.

Issue Area 5

5 North. Issue Area 5 North generally incorporates the inland areas of northern Lee County and southern Charlotte County, including North Fort Myers. Natural features include the Fred C. Babcock/Cecil M. Webb Wildlife Management Area, Gator Slough, Telegraph Swamp, Trout Creek and many tidally influenced creeks that drain south into the Caloosahatchee River. The area consists of a mixture of low to medium density urban, agricultural and natural areas. The following generalized characteristics and issues were identified for Area 5 North:

Demand Characteristics

- Utilities: Lee County Olga
- Minor increases in population and PWS demands projected
- Anticipated low urban growth

Resource Availability

- Utility plans to use surface water from Caloosahatchee River
- Limited ground water resources

Reclaimed Water Availability

- North Fort Myers WWTF
- 1997 wastewater treated - 1 MGD; .75 MGD reused

Water Storage Ability

- ASR - Caloosahatchee as a source

Based on the above, it was concluded current levels of development are not harmful to the resources. The growth is anticipated to be supported by increased withdrawals from the C-43 Canal, self-supply, and continued expanded use of reclaimed water. There is some transitioning from agriculture to urban land uses.

5 South. Issue Area 5 South generally incorporates the inland areas of south-central Lee County, including Lehigh Acres and San Carlos Park. Natural features include the Six Mile Cypress Slough, portions of Corkscrew Swamp, Orange River and other tidally influenced creeks that drain north into the Caloosahatchee River. The area consists of urban and agricultural areas, with some of the agriculture transitioning into urban land uses. The following generalized characteristics and issues were identified for Area 5 South:

Demand Characteristics

- Utilities: Lee County Corkscrew and Green Meadows; Gulf San Carlos and Corkscrew; Lehigh
- Moderate increases in population and PWS demands projected
- Anticipated large urban growth in Lehigh Acres and South Lee County
- Transition in land use from agriculture to urban in south-central Lee County
- Medium scale development
- Cumulative domestic well impacts in Lehigh Acres area
- About 20,000 acres of agriculture (citrus & vegetables) with some increase projected

Resource Availability

- Utility plans to use surface water from Caloosahatchee River, water table aquifer and Sandstone aquifer
- Limited resources: water table limited in southern portion by wetlands; variable yield in Sandstone

Reclaimed Water Availability

- 1997 wastewater treated - 2 MGD; 1.25 MGD reused
- 2020 projected wastewater flows - 4 MGD
- Limited availability- regional utilities being developed by Lee County and Fort Myers

Water Storage Ability

- Rock pits
- Canal optimization
- ASR - Caloosahatchee as a source
- Lee County ASR

Based on the above, it was concluded current levels of development are not harmful to the resources. It was recognized that there are opportunities to expand the withdrawals from the SAS and Sandstone aquifer, as well as increased water use from the C-43 and other surface water sources. This area is transitioning from agriculture to urban land uses, such that potable needs and irrigation needs are issues.

Issue Area 6

Issue Area 6 generally incorporates primarily surface water supplied agriculture areas in Hendry County and portions of Glades and Charlotte counties, and includes LaBelle, Clewiston and Moore Haven. Natural features include a northern portion of Okaloacoochee Slough. The following generalized characteristics and issues were identified for Area 6:

Demand Characteristics

- 140,000+ acres of agriculture (citrus, sugarcane & vegetables) with significant increases projected
- CWMP
- Caloosahatchee Estuary

Resource Availability

- C-43
- Water table aquifer
- Sandstone aquifer- general aquifer protection exceedances projected in some areas
- FAS - lower salinity in this area than rest of LWC Planning Area

Reclaimed Water Availability

- None

Water Storage Ability

- Reservoirs: regional and on-site
- ASR using surface water from C-43 or local surface water systems

The CWMP is addressing surface water availability within this area, including the needs of the Caloosahatchee Estuary. As a result, the CWMP process and recommendations will be summarized in the LWC Water Supply Plan, and the CWMP document will be incorporated by reference. Many members of the CWMP Advisory Committee also serve on the LWC Water Supply Plan Advisory Committee.

For the ground water use in this area, it was concluded the potential general aquifer protection exceedances could be managed through modifications to wellfield configurations and pumping regimes. Another issue that was discussed related to the use of water from the Sandstone aquifer was the presence of inefficient withdrawal facilities on domestic wells. When water levels in these wells fall to greater than 20 feet below land surface, these withdrawal facilities (vacuum pumps or pump types whose centerline is above the surface of the water) fail. Historically, replacement of these facilities (pump and well) was the responsibility of adjacent agricultural water users. It was recommended local governments prohibit the construction of these types of facilities through ordinances.

There was a discussion about protection of inefficient facilities. Mobile irrigation labs (MILs) were supported to promote efficient use of the resources.

Issue Area 7

Issue Area 7 generally incorporates western Hendry County and northeastern Collier County, including the Immokalee area. Natural features include the southern portion of Okaloacoochee Slough, Twelve Mile Slough with small northern portions of the Florida Panther National Wildlife Refuge, and Big Cypress Preserve. The area is primarily ground water supplied agriculture. The following generalized characteristics and issues were identified for Area 7:

Demand Characteristics

- 20,000+ acres of agriculture (citrus & vegetables) with moderate increase projected

Resource Availability

- Sandstone, lower Tamiami and water table aquifer systems primarily used
- Sandstone aquifer primary source west of SR 29; lower Tamiami primary source east of SR 29
- Withdrawals limited by:
 - wetland protection
 - Sandstone aquifer protection criterion

Reclaimed Water Availability

- None

Water Storage Ability

- Reservoirs: regional and on-site

The primary water supply related issue in this area is meeting the water needs of agriculture. Even though there are some limitations on existing freshwater sources within this area, it was concluded projected agricultural water demands could be met from existing sources through modifications to wellfield configurations and pumping regimes with respect to location of wetlands. The potential of using water from the FAS for blending was also mentioned to extend freshwater supplies, if necessary.

Similar to Issue Area 6, domestic wells with inefficient withdrawal facilities was also identified as a potential issue and MILs were also supported in this area.

Issue Area 8

Issue Area 8 generally consists of the environmental areas in Southeast Collier County and Northwest Monroe County including Big Cypress National Preserve, Picayune State Forest, Fakahatchee Strand State Preserve, Florida Panther National

Wildlife Refuge, Everglades National Park, and southern Golden Gate Estates. The following generalized characteristics and issues were identified for Area 8:

Demand Characteristics

- Mainly environmental
- Includes Everglades City, Ochopee, Chokoloskee, and Port of the Islands PWS systems, and numerous domestic self-supply wells
- Represents large modified ecosystem

Resource Availability

- There may be water available as the result of environmental restoration
- Land acquisition underway

Reclaimed Water Availability

- None

Water Storage Ability

- Could be used as storage area (only when environmentally beneficial)

Most of this area represents a large modified ecosystem with significant land acquisition proposed. It was recommended that the land acquisition be completed. There may be water available as the result of environmental restoration. The need for identifying the water needs of the natural resources was discussed. With environmental restoration in this area and establishment of hydroperiods for the natural systems, increases in surface water availability during certain times of the year and ground water recharge should be realized and possibly transferred to other areas. The primary reason for this hydrological restoration is re-establishment of historic flowways, sheetflow and hydroperiods, that will also improve the health of the estuary. Also, it is recognized these are fringe areas and water quality, including saltwater intrusion, must be considered.

Summary of Natural Systems and Water Resource Analysis**Minimum Flows and Levels**

Two water resources in the LWC Planning Area are on the District's priority list for establishment of MFLs: the Caloosahatchee River and Estuary and the LWC aquifer system. Both of these are scheduled for establishment by the end of Year 2000. White papers are being written to support establishment of each of the MFLs. A summary of the proposed approach for each of these is provided below. The establishment process will include public participation, peer review, and rulemaking. The established MFL will be incorporated into the update of this plan.

Caloosahatchee River and Estuary. The proposed Caloosahatchee River and Estuary MFL is based on maintaining salinity levels that would avoid significantly

harmful levels in the Caloosahatchee Estuary. Research data were used to relate flow rates from S-79 to salinity distributions along the Caloosahatchee Estuary and to correlate biologic community responses to varying salinity distributions. These relationships were established for submerged aquatic vegetation, fish and invertebrates with major emphasis on the salinity requirements of the freshwater grass, *Vallisneria*. It was determined that the distribution and abundance of *Vallisneria* at a location approximately 30 kilometers upstream of Shell Point is the best biological indicator addressing low flow needs for the restoration of the Caloosahatchee Estuary. The magnitude of die off that requires two years to recover from and the resulting impact to fisheries resulting from the loss of *Vallisneria* habitat was considered to be significantly harmful and formed the basis of the proposed MFL criteria.

A model was developed from field and laboratory information to determine the response of *Vallisneria* to various concentrations and duration of saltwater. This model was used to define low flow events that would produce salinity concentrations of sufficient duration and frequency that would result in significant die-off of *Vallisneria*. Significant die-off of *Vallisneria* would be defined as areas where the presence of *Vallisneria* is reduced to less than 20 shoots per square meter measured at a monitoring station located approximately 30 kilometers upstream of Shell Point during the months of February through April. Significant harm to the Caloosahatchee Estuary is considered to occur when *Vallisneria* die-back, due to high salinity from low freshwater inflows, occurs for three years in a row. Harm to the Caloosahatchee Estuary is considered to occur when *Vallisneria* die-back, due to high salinity from low freshwater inflows, occurs for two consecutive years measured at a monitoring station located approximately 30 kilometers upstream of Shell Point. It was determined the freshwater inflow associated with preventing harm or significant harm is an average monthly flow of 300 cfs per day at the S-79 Structure during the spring.

An evaluation of projected flows to the Caloosahatchee River was conducted via the LEC Water Supply Plan and the CWMP for 1990 base and 2020 base conditions. The results of these evaluations indicate that the proposed MFL criteria and the restoration base flow needs of the Caloosahatchee Estuary are not being met. Pursuant to the direction provided in Section 373.042 F.S., a recovery plan is provided in the LEC Water Supply Plan. The recovery plan consists of design and construction of enhanced basin storage capacity using surface water, ASR, and reservoirs as described in the Restudy and refined through the CERP and Southwest Florida Study. A 31-year time series of flows that would result from the works of the Restudy were also simulated and used to define the proposed "Recovery and Prevention Strategy for Minimum Flows". In the interim, an adaptive management strategy, with discretionary releases through the S-77, will be utilized.

Lower West Coast Aquifer System. The Lower West Coast (LWC) aquifer system is comprised of the water table aquifer, the lower Tamiami aquifer, the Sandstone aquifer, the mid-Hawthorn aquifer, and the Floridan aquifer. The principal issue regarding development of minimum level criteria for the LWC aquifer system is the problem of introduction of air into confined aquifers and depleting storage in unconfined aquifers. Confined aquifers are anaerobic, and the introduction of air into these can cause chemical

and physical changes to the confining layers of the aquifer resulting in changes to these confining layers. As a result, the permeability and specific storage of the aquifers, aquifer interbeds, and confining beds are reduced, thereby reducing the production potential of the affected aquifers. The minimum level for these aquifers will be established above the top of the aquifer to prevent introduction of air into the aquifer.

For unconfined aquifers, as the water level falls in the aquifer, the transmissivity, which is the product of the hydraulic conductivity and saturated thickness, declines. At the same time, water available in storage is depleted. The net result, especially in thin aquifers with low hydraulic conductivity, is an increasing rate of drawdown in the vicinity of pumping wells, and possible failure of wells due to local dewatering of the aquifer. In addition, the resulting depressurization can cause aquifer compaction, particularly in those aquifers comprising poorly consolidated sediments. Therefore, the approach taken is that the minimum water level in unconfined aquifers be limited to a drawdown that is no more than half of the pre-development average of saturated thickness of the aquifer.

The minimum levels that have been proposed for the LWC aquifer system represent a best estimate based on currently available information of the levels below which significant harm is likely to occur. Implicit in this determination is the assumption that water conditions that pose significant harm, will be of fairly infrequent occurrence and comparatively short duration. Therefore, it is assumed that if the physical system is more sensitive to introduction of air than estimated, the brevity of the occurrence would offset it. Development of minimum water level criteria for the LWC aquifer system as a means to protect the aquifers from significant harm should not change the application of drought management methods and criteria that affect operation of individual wellfields.

The results of the analysis associated with the 1994 LWC Water Supply Plan and CUP program suggests that the projected water levels, based on future demands, in the LWC aquifers, are above the proposed aquifer minimum levels. Pursuant to the direction provided in Section 373.042 F.S., a prevention strategy is required. The LWC aquifer system prevention strategy will be to establish regulatory levels for a 1-in-10 level of certainty at the no harm level. These will be established and implemented through the CUP process. For droughts greater than a 1-in-10 event, water use will be reduced through declarations of water shortage via Chapter 40E-21, F.A.C., to prevent significant harm.

Summary of Results

Based on the results of this assessment and the analysis associated with the 1994 LWC Water Supply Plan, there are several potential water supply issues projected to occur by 2020 during a 1-in-10 year drought event if current facilities and historically used sources of water are used. Many of these were identified in the 1994 LWC Water Supply Plan and can be resolved through the ongoing implementation of that plan. The potential issues identified in the individual issue areas could be summarized into coastal issues and inland issues. A summary of the water supply related issues in the LWC Planning Area is provided in **Table 3**.

Table 3. Lower West Coast Water Supply Issues Summary.

	Inland	Coastal
Collier County	<ul style="list-style-type: none"> • Cumulative impacts (wetlands) 	<ul style="list-style-type: none"> • Cumulative impacts (wetlands) • Saltwater intrusion • Expansion of SAS limited • Limited freshwater for irrigation • Freshwater discharges to estuarine systems
Hendry County	<ul style="list-style-type: none"> • Surface water availability in C-43 Basin • Cumulative impacts (wetlands) 	N/A
Lee County	<ul style="list-style-type: none"> • Surface water availability from the C-43 • Freshwater discharges to the Caloosahatchee Estuary 	<ul style="list-style-type: none"> • Cumulative impacts (wetlands) • Expansion of SAS available, but limited • Saltwater intrusion (Lower Tamiami in South Lee County) • Freshwater discharges to the estuarine systems • Limited freshwater for irrigation

Coastal Issues

The area west of I-75 from the northern Lee County line to Ten Thousand Islands in Collier County and the coast is projected to experience significant increases in population and water demands in the form of potable water and irrigation demands. Within this corridor, the analysis indicated expansion of withdrawals from historically used fresh ground water sources might be limited due to the potential of saltwater intrusion and impacts to wetlands. However, there appears to be sufficient water sources through diversification with FAS water, surface water, and complemented with fresh water storage through ASR, in addition to the historically used fresh ground water sources, to meet potable water demands. It was also concluded that the combination of reclaimed water, surface water, and historically used fresh ground water sources are adequate to meet the projected irrigation demands, but additional work is necessary to identify the most effective method to make these sources available for use at the local level, including storage.

Inland Issues

Inland issues are generally issues related in meeting the LWC Planning Area agricultural water demands. In the Caloosahatchee Basin (the portion of the LWC Planning Area in the Lake Okeechobee Service Area), surface water availability from the C-43 Canal to meet agricultural and public water supply needs, as well as addressing freshwater discharges to the Caloosahatchee Estuary to maintain a healthy estuarine system, are being addressed in the Caloosahatchee Water Management Plan. A MFL for the Caloosahatchee River and Estuary is also being developed. These issues will be

resolved principally through storage and capture of rainfall/runoff in conjunction with the use of the C-43 Canal and water from Lake Okeechobee.

In southeastern Lee County and the remaining portion of Hendry County not in the Caloosahatchee Basin, this assessment indicates historically used ground water sources in some areas may be limited by potential impacts to wetlands and existing legal users; and in some limited areas, excessive drawdowns in the aquifer. However, based on several factors identified in the 1994 LWC Water Supply Plan Results section of this plan, many of these can be avoided through development of water supplies consistent with the CUP criteria for impacts to existing legal users, wetlands, and over drafting of the aquifer on a local scale.

Potential solutions, or water source options, to resolve these issues are discussed in Chapter 5 (Solution Development). For each water source option, a definition, summary of the committee discussion, estimated costs, quantity of water that could be made available from that option, as well as regional and local recommendations to facilitate development of that option are listed. Chapter 6 (Recommendations) breaks the regional recommendations down into tasks, total and annualized cost to implement that recommendation, the entity/agency responsible for implementing the recommendation, and funding sources.